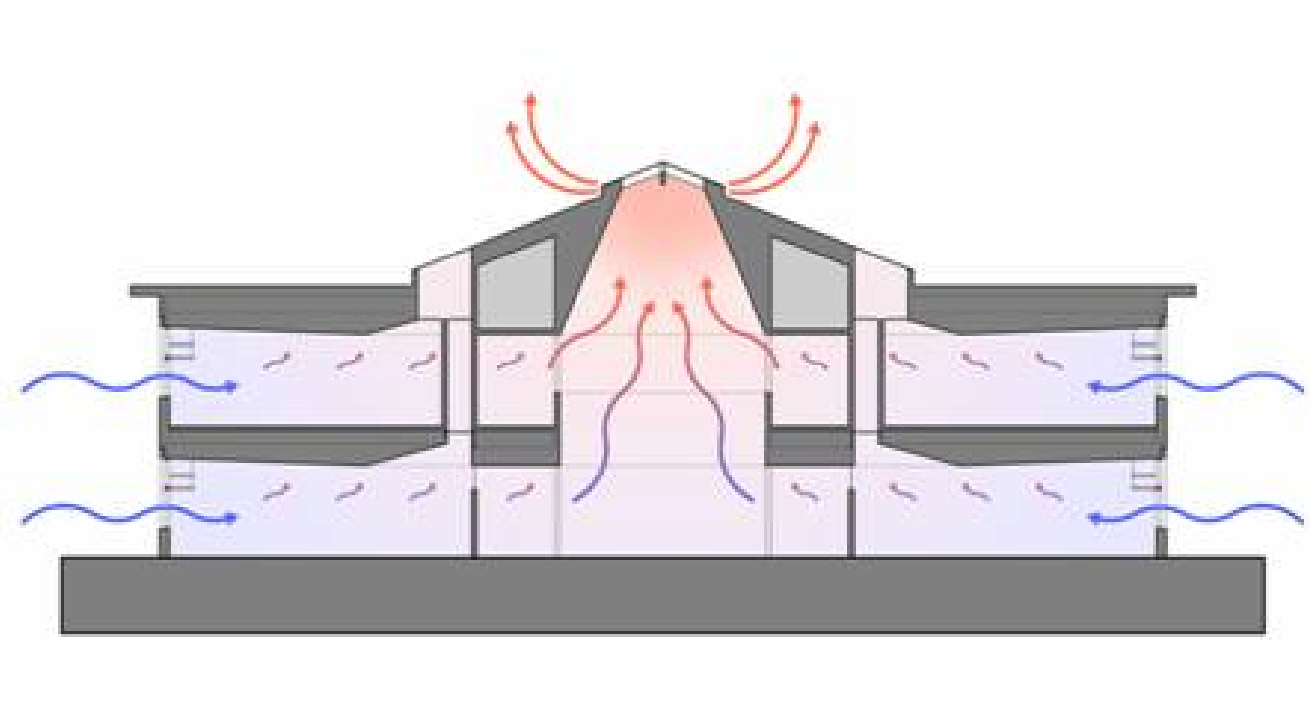
High Performance Schools: An Overview

Paul Hutton

AIA, Principal, Hutton Ford Architects, PC

Why high performance design?



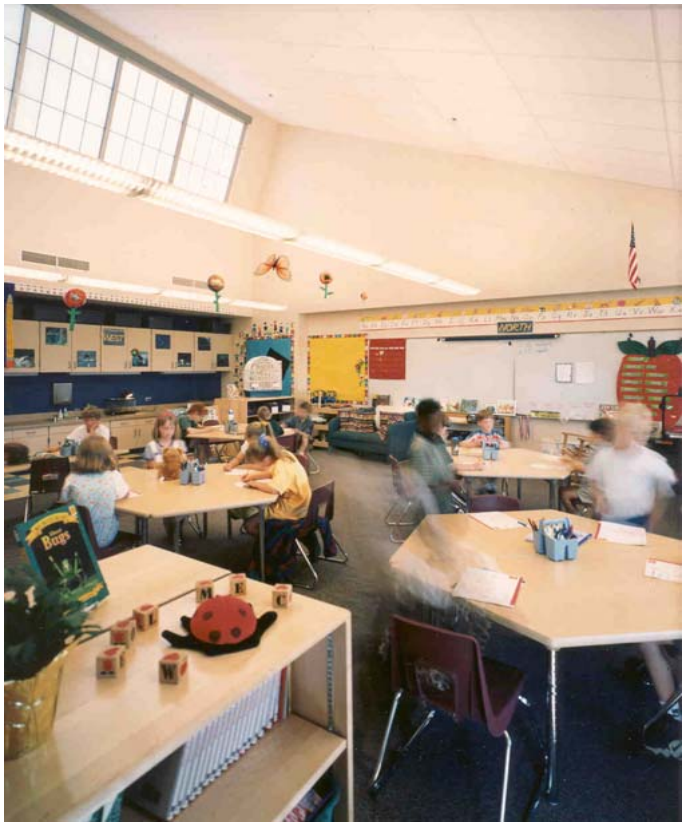
The State of U.S. Schools

- Average age of U.S. schools – 42+ years
- Majority of schools built before 1970
- GAO Report – 41% report unsatisfactory energy efficiency
- Schools spend $7.8 billion on energy each year – the largest budget item after salaries
- More $$ is spent on energy than for computers and textbooks combined.
- Approximately $54 million spent daily on school construction.

What is a High Performance School?

Healthy
Comfortable
Efficient
Easy to Maintain and Operate
Commissioned
Environmentally Responsive
A Teaching Tool
Safe and Secure
A Community Resource
Stimulating Architecture

Healthy



Comfortable

- Thermally
- Visually
- Acoustically

Efficient

- Energy
- Materials
- Water

Easy to Maintain and Operate

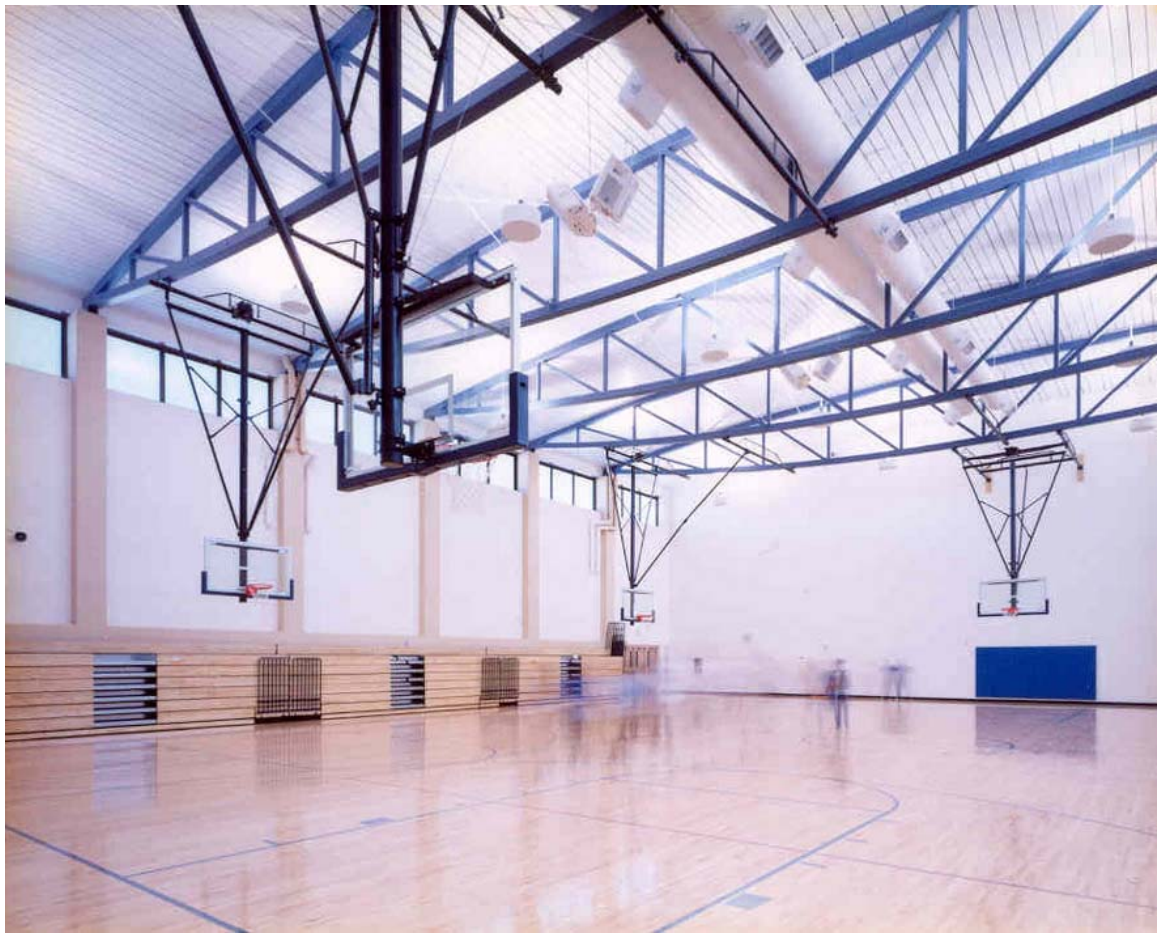
Commissioned

Environmentally Responsive

A Teaching Tool

Safe and Secure

A Community Resource



Stimulating Architecture

Why Are High Performance Schools Important

Increased Learning and Performance

Increased Attendance

Increased Teacher Retention

Reduced Operating Cost

Reduced Liability

Reduced Environmental Impact

Increased Student Learning and Teacher Performance.

Research: Daylighting Benefits

Research conducted:

- 21,000 students
- Three districts
- Washington, California, Colorado

Results:

In one district, students with more daylighting:

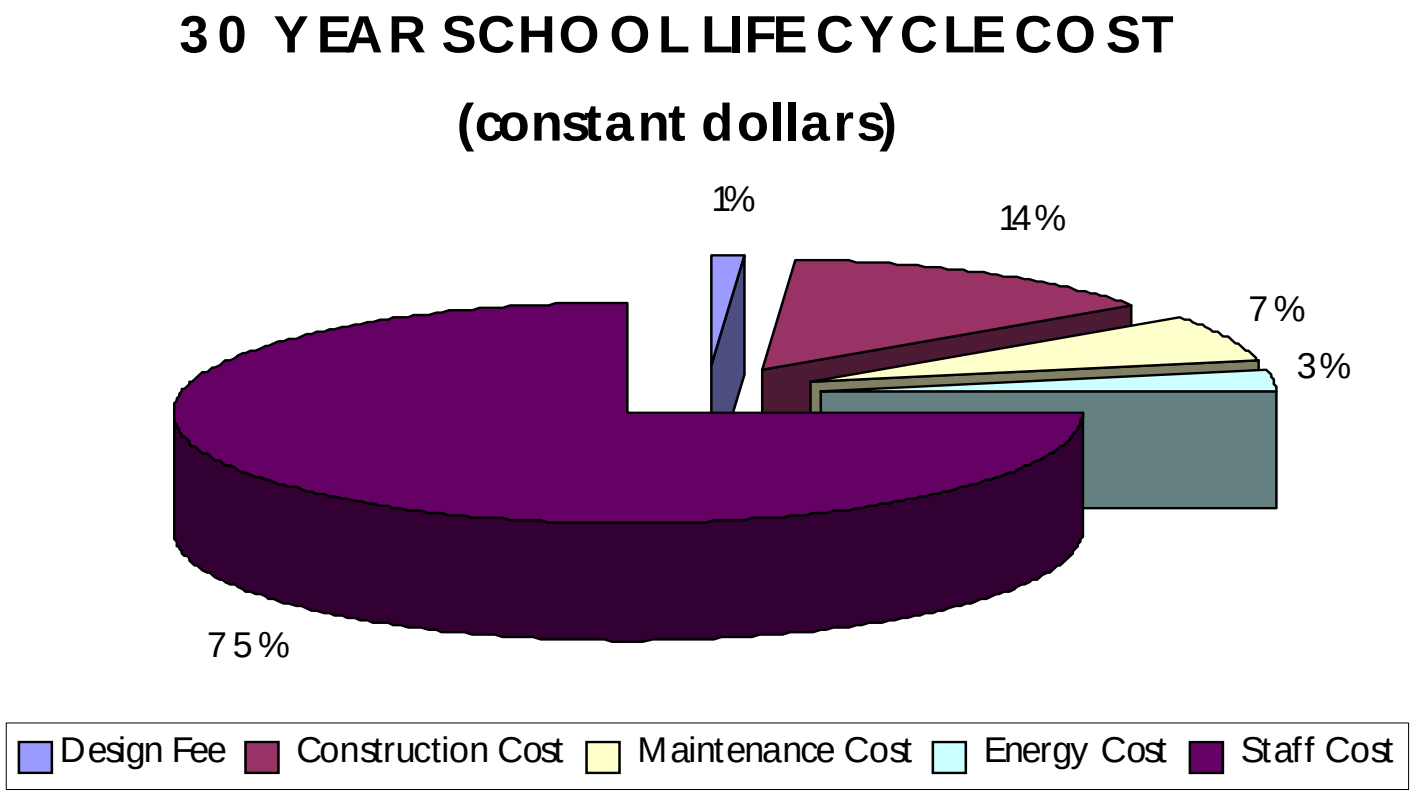
- Progressed 20% faster on math
- Progressed 26% faster on reading

In the other two districts, students with more daylighting:

- Had 7% to 18% higher test scores

Full report available at www.h-m-g.com

Impact of Teacher Salaries



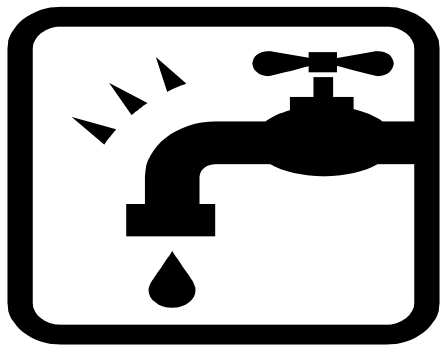
Increased Average Daily Attendance (ADA).

Increased Teacher Satisfaction and Retention.

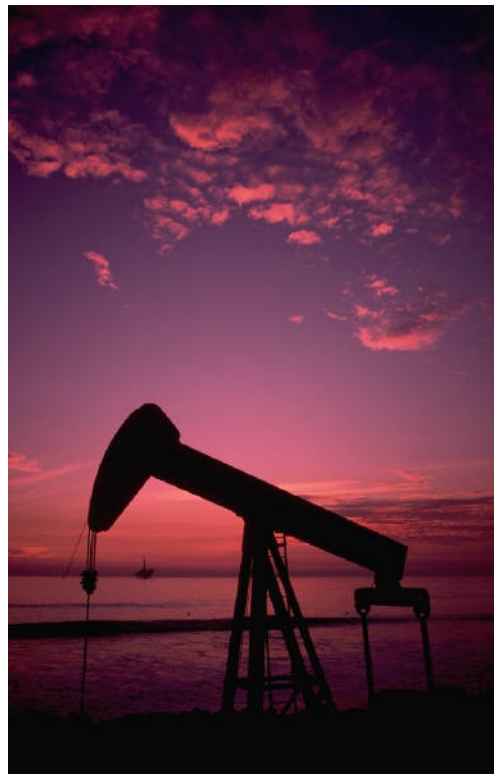
Reduced Operating Cost.

Maintenance

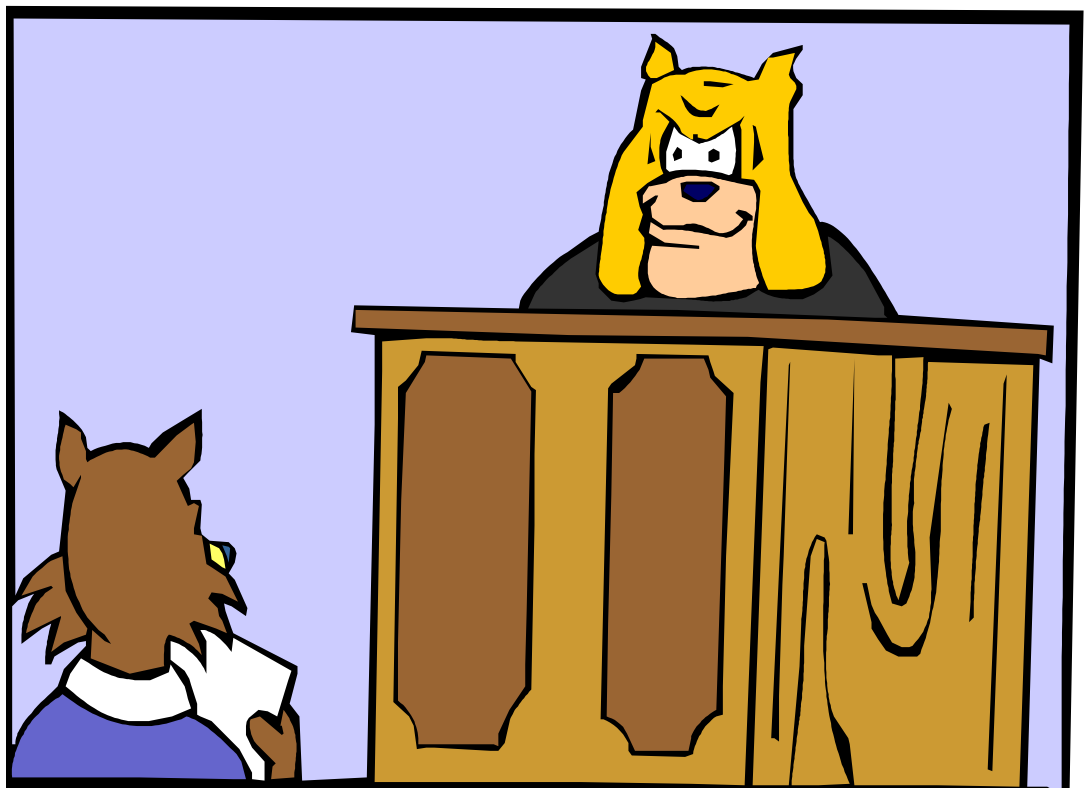
Water



Energy



Reduced Liability



Reduced Environmental Impact

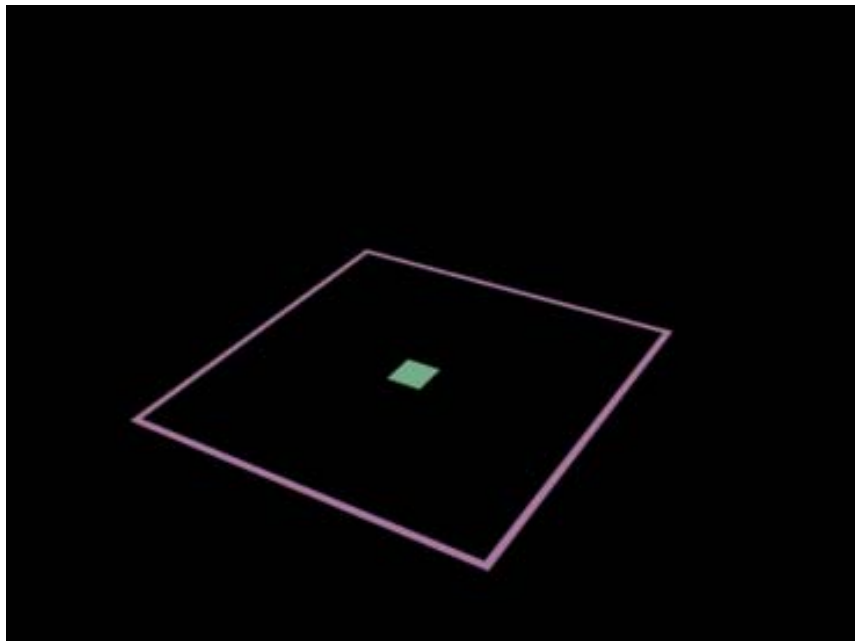
The High Performance Classroom

Goals of a High Performance Classroom

- Visual, thermal and acoustic comfort.
- Good outside air ventilation.
- Excellent indoor air quality.
- Energy, material, and water efficiency.
- Provide a lesson on sustainable design.

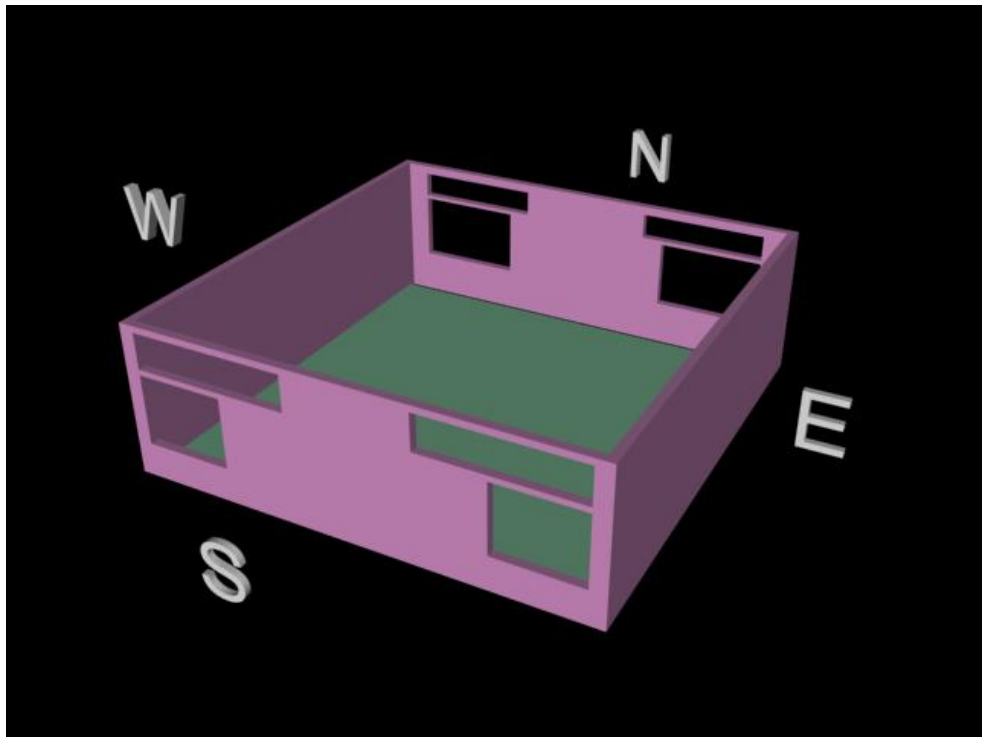
High Ceilings

- Average classroom is 30’ x 30’.
- High ceilings enhance space and provide better illumination, ventilation. and acoustics.
- Floor-to-ceiling height should be at least 10’.



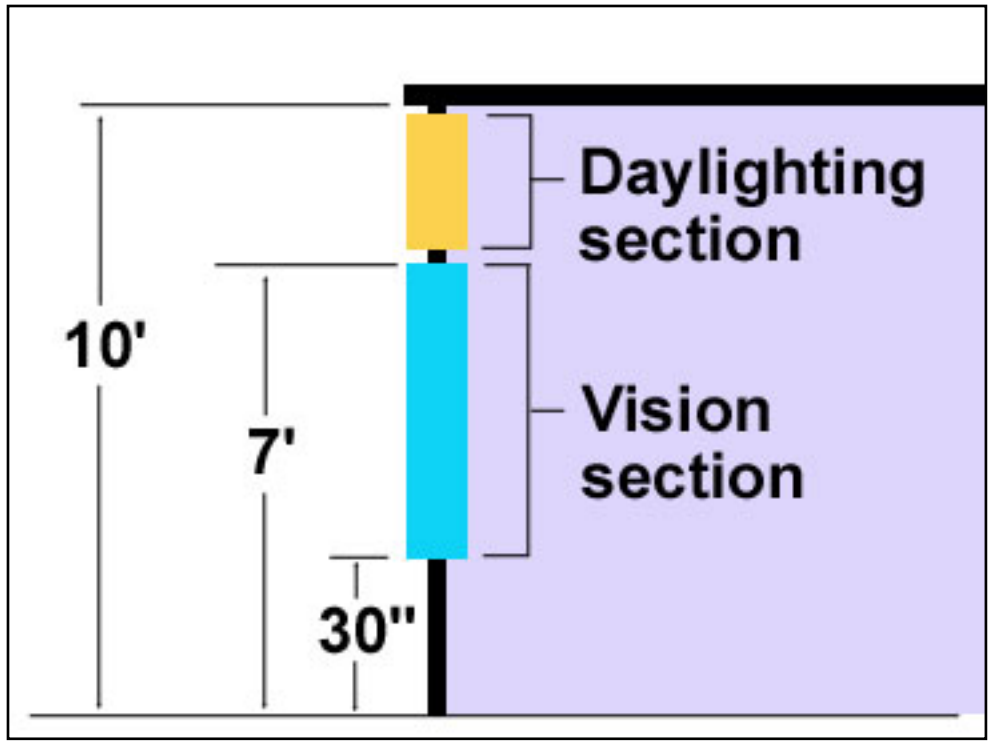
Orient Windows North/South

- Windows should be oriented either north or south.
- Locate windows at edges of room to prevent dark corners and wash teaching wall.



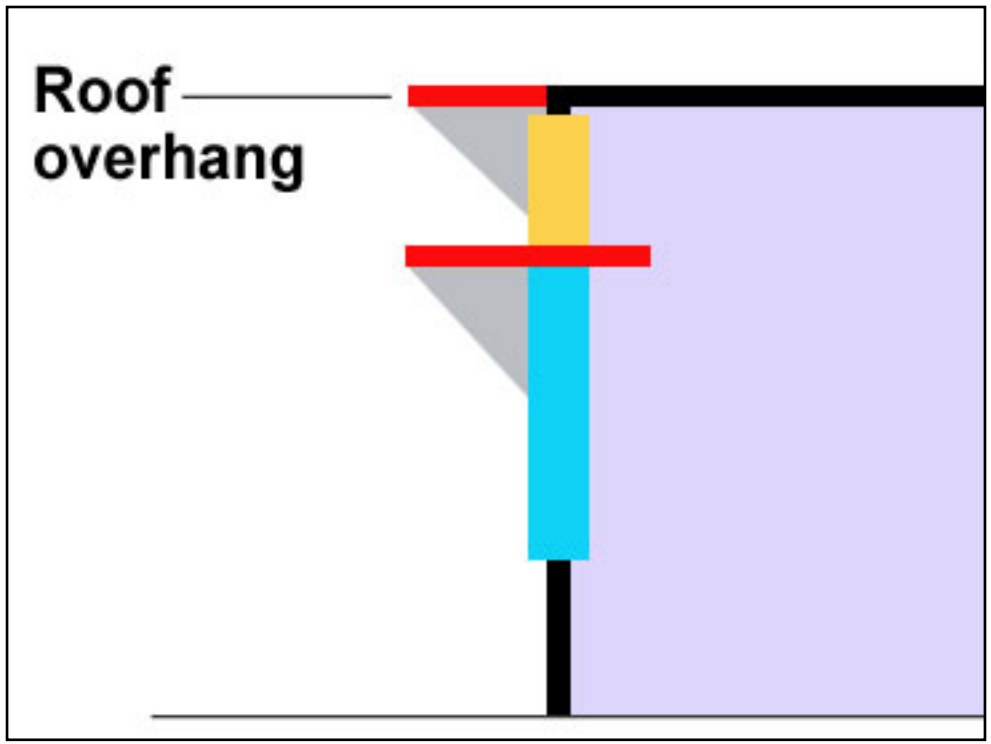
Window Sections

- Daylighting section allows sunlight in to illuminate room.
- Vision section glass should be double glazed and should be operable.



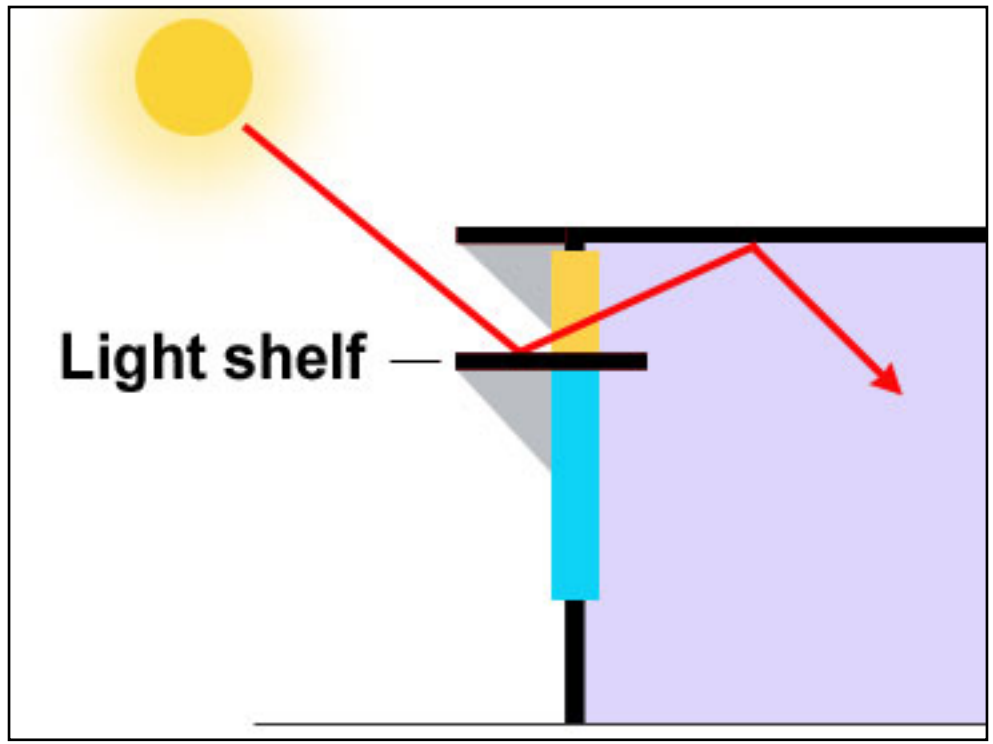
Roof Overhangs

- Overhangs should be added to south-facing windows to prevent glare and to reduce solar heat gain.



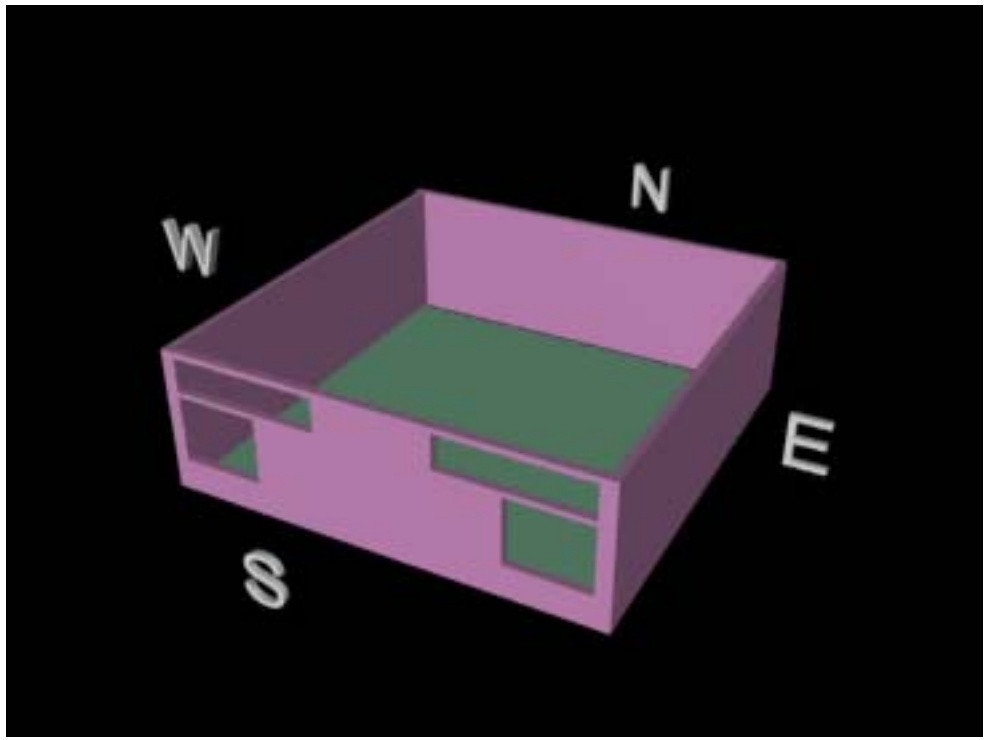
Light Shelves

- A light shelf should be added to reflect light onto the ceiling and into classroom.
- Light shelf also acts to shade the vision section of the window.



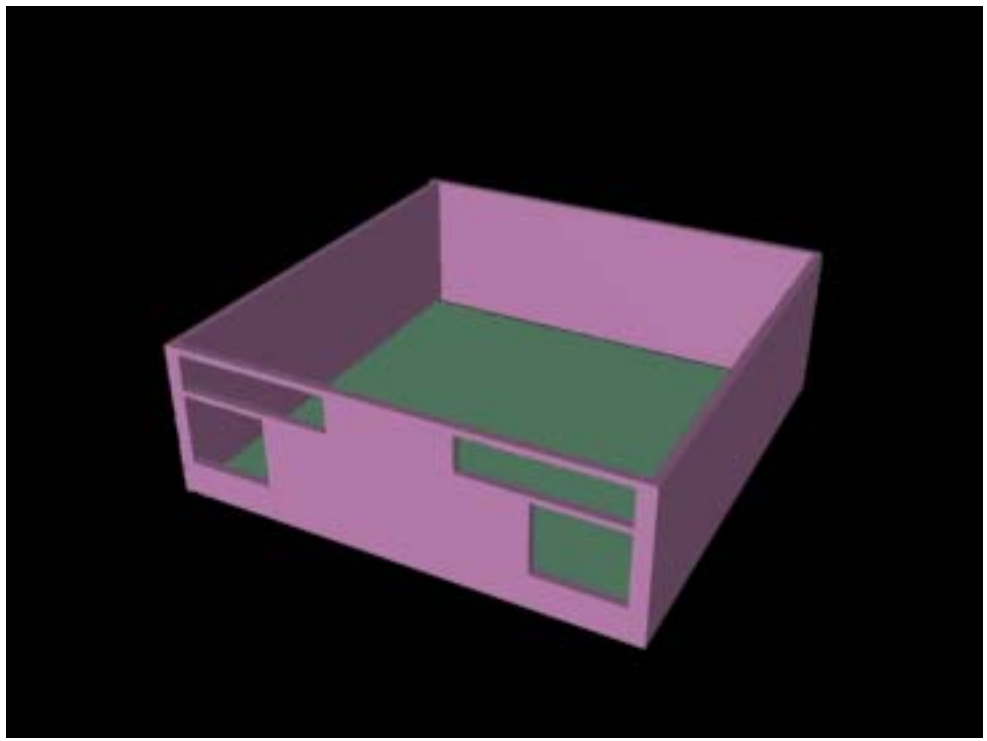
Skylights

- Skylights or clearstories should be used to illuminate the back wall of the classroom. Light shelf also acts to shade the vision section of the window.
- Use skylights with glazing to diffuse light.



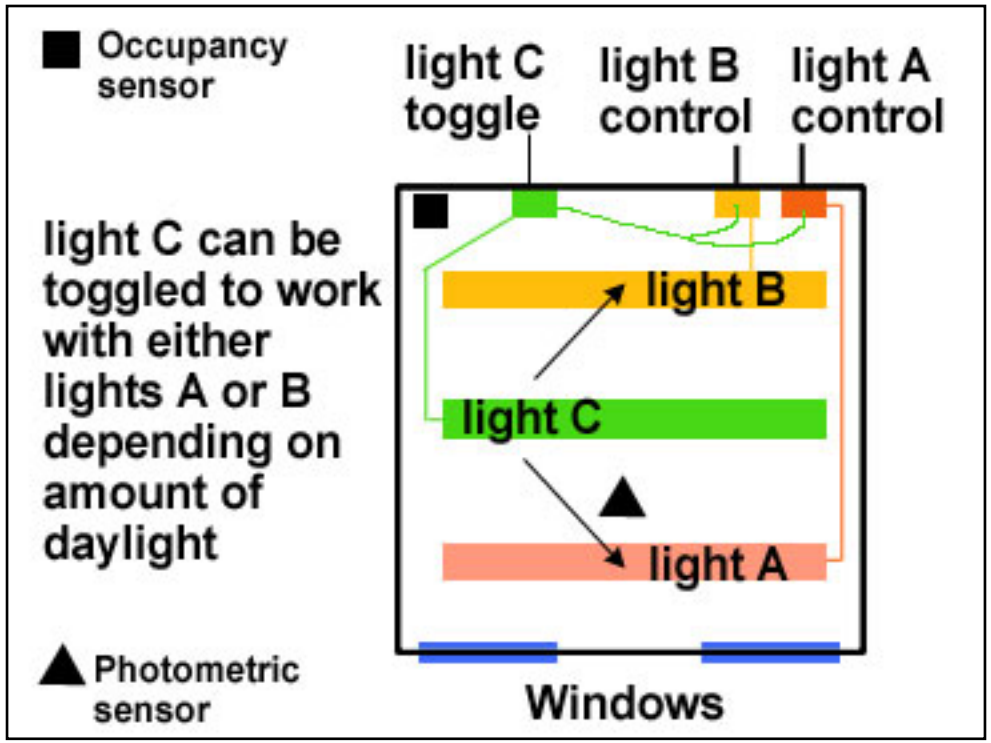
Electric Lighting

- Designed according to the characteristics and use of the space



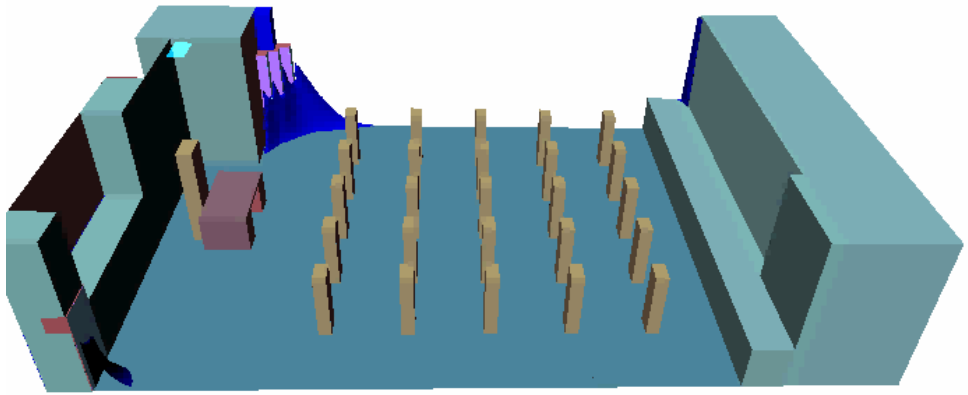
Lighting Control

- Occupancy sensors shut off lights if room is unoccupied.
- Separate controls for each light based on daylighting availability.



Displacement Ventilation

- Fresh cool air is slowly supplied near the floor.
- Air rises as it warms.
- Air is exhausted near the ceiling.



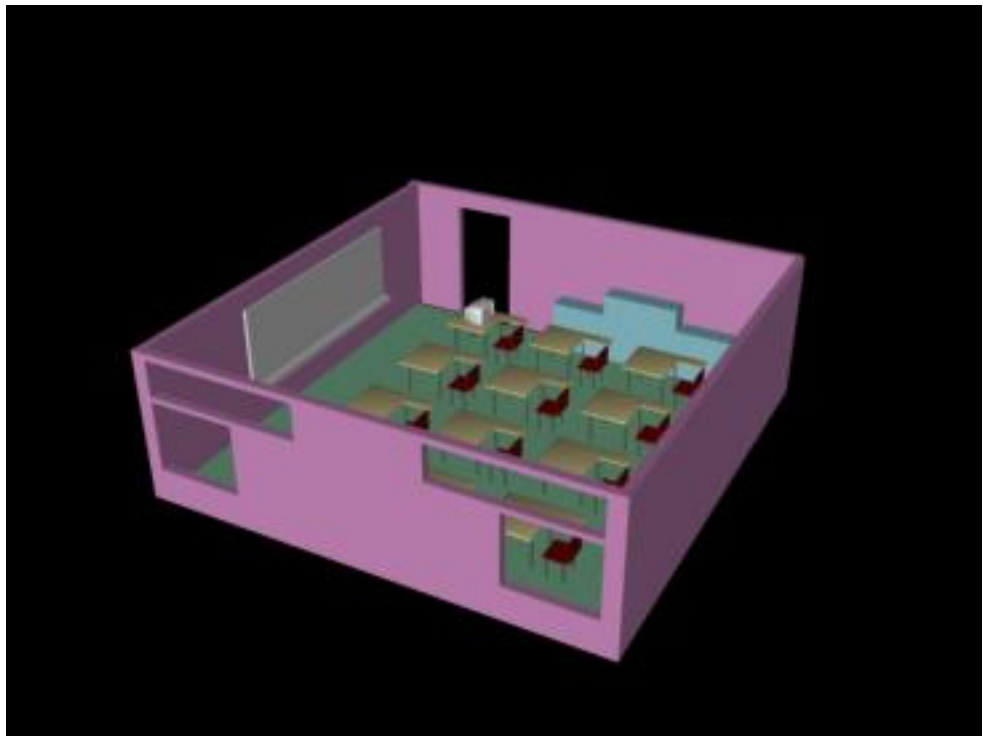
Courtesy H. L. Turner Group

Furnishings & Materials

- Choose flooring materials that are resource efficient.
- Avoid particle board.
- Use low-emitting paint and adhesives, and apply them before installation of carpet or ceiling tiles.
- Ceilings and upper walls should be light in color with 80%+ reflectance.

Classroom Layout

- Locate teaching wall and desks perpendicular to window wall.
- Angle computer monitors to prevent glare on screen.



The Importance of Integrated Design

	Goals/Cross-Cutting Issues									
	Health and IAQ	Thermal Comfort	Visual Comfort	Acoustic Comfort	Security and Safety	Ecosystem Protection	Energy Efficiency	Water Efficiency	Materials Efficiency	Building as a Teaching Tool
General Conditions	●				●	●	●	●	●	
Site Planning	●	●	●	●	●	●	●	●	●	●
Interior Surfaces & Furnishings	●			●		●	●		●	●
Electric Lighting and Controls		●	●				●			●
Daylighting and Fenestration		●	●		●		●		●	●
Building Enclosure		●		●			●		●	●
HVAC	●	●		●	●		●	●	●	●
Other Equipment and Systems							●	●	●	●

The High Performance School

Healthy
Comfortable
Efficient
Easy to Maintain and Operate
Commissioned
Environmentally Responsive
A Teaching Tool
Safe and Secure
A Community Resource
Stimulating Architecture